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(54) METHOD FOR OIL POOL DEVELOPMENT

(56) Maksimov, M. I., Geological Fundamentals of Oil Deposit Development

(57) The essence of the invention: a solvent is injected through an input well into the stratum. The solvent used is an oil-water emulsion with a water content in the emulsion of 15 to 45%.

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The invention relates to the oil production industry and can be used in developing pools of high-viscosity oil.

A means of developing oil pools is known which includes drilling producing and input wells and steady-state injection of water through the input well into the productive strata. However, in pools of high-viscosity oil, this method is ineffective. This is because the high mobility ratio of injected water and displaced oil does not ensure satisfactory oil recovery of strata -- after commencement of water influx into productive wells, water encroachment of the withdrawn fluid increases with catastrophic speed. Along with this, there is insignificant additional withdrawal of oil, and it is necessary to cease commercial oil extraction.

Another method of oil pool development is known which is assumed here to be the prototype. It includes drilling producing and input wells and subsequent injecting of light hydrocarbon fringes. These are moved by water along the stratum. Since in this method light hydrocarbons are used, this does not permit a lowering of the mobility of the displaced medium. Therefore, use of this method is possible only for displacing low-viscosity oil.

In addition, this method is not effective enough. In the first place, it requires special preparation of the recovered fluid in order to separate out pure oil. Secondly, for injection into productive strata, an increased amount of oil, rather than the preferred reduced amount, is expended.

The goal of the invention is to increase the oil output and increase the cost effectiveness of the technological process.

The goal established is attained by alternately injecting water and a water-oil emulsion consisting mostly of oil into the productive strata, rather than oil. This emulsion is formed spontaneously in oil fields when partially water-encroached productive wells are exploited. Its breakdown and separation into pure oil and water is somewhat difficult technically. The current method simplifies the process considerably. Preparation of pure oil is not required for injection into productive strata; it is possible to use the oil-water emulsion obtained from wells. One important feature of the oil-water emulsion is the fact that its viscosity is greater than that of the high-viscosity oil that is included in its composition. It turns out that addition of low-viscosity water to high-viscosity oil to form an emulsion results not in a reduction, but rather in an increase in viscosity. Accordingly, there is an increase in overall viscosity of the body of injected water, separated by the multitude of partitions in the oil-water emulsion. Owing to an increase in overall viscosity of the displacing agent, the effectiveness of the alternating injection is increased. Oil recovery from strata increases.

When the displacing agent is filtered through a porous medium, to some extent there is a possibility that the oil-water emulsion will be broken down and separated into its constituents, oil and water. So that the positive effect of alternating high-viscosity oil with water is retained, oil must constitute a majority of the oil-water emulsion. Then within the confines of high-viscosity partitions, oil will be the basic carrier phase, and water the non-basic carried phase.

Example. In the oil pool under examination, the dependence of viscosity of the oil-water emulsion on the percentage of water in it is characterized by the following numerical values.

The adduced numerical values approximately correspond to

the following mathematical formula of the coefficient of emulsion viscosity increase, depending on water percentage:

" $e^{3\ 8} = 20B$

In using an emulsion with a water share of B = 0.45, the coefficient of emulsion viscosity increase = 3.85. By comparison with the known method (patent 1195717), the oil share in the volume of the displacing agent drops from 10% to 10 (1-0.45) = 5.5%. Correspondingly, extracted oil reserves increase by

(100% - 5.5%) / (100% - 10%) = 1.05 times.

In the high-viscosity oil pool under examination, use of the known development method (patent 1195717) causes oil reserves in the amount of 40,000,000 tons to be extracted. Using the present method, it increases to 40 x 1.05 = 42,000,000 tons. The increase amounts to 2,000,000 tons of oil. At a prospecting cost of 10 rubles per 1 ton of extracted oil reserves, owing only to saving that part of expenditures that is for prospecting, this method ensures savings of 10 x 2 - 20,000,000 rubles.

The annual extraction of oil in the oil pool under examination with the known development method (patent 1195717) is 2,000,000 tons. Accordingly, with the current method, development is 2 x 1.05 = 2,100,000 tons, or greater by 100,000 tons. At a price of 100 rubles per ton of oil, and with expenses for extraction of 60 rubles per ton of oil, the savings from extraction of each ton of oil are (100-60) = 40 rubles. The annual savings from supplemental oil extraction are 40 x 0.1 = 4,000,000 rubles. Over the full number of years this oil pool is developed, it will be 40 x 2 = 80,000,000 rubles. To sum up, the overall effect from savings of expenditures in prospecting, and the additional savings in development by using this method of development will be 20 + 80 = 100,000,000 rubles.

Patent claims:

Method for oil pool development, including withdrawal of oil through productive wells and [injection of dosages?] of solvent and water through input wells, characterized in that for the purpose of increasing the method's effectiveness, owing to simplification of the injection process and reduction in oil expenditure, an oil-water emulsion with water content of 15-45% is injected into the stratum.

B - percentage of water in the oil-water emulsion	0.00	0.15	0.30	0.45
Coefficient of oil-water emulsion viscosity increase compared with oil viscosity	1.00	1.86	2.27	3.70

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[Translator's notes - not included in the word count: some small symbols, particularly mathematical symbols, are indistinct in the fax copy I used and should be checked against the

original. About 8 or 9 words were too indistinct to read for certain. Where a guess is made, it is in [] square brackets.]